Fossil plants.—PELOURDE[3] has contributed the first published volume to the "Bibliothèque de paléontologie," which in turn is one of the 40 divisions of the "Encyclopédie scientifique" under the general direction of TOULOUSE. Under Paleontology, 15 volumes are projected, 3 of which are to be on Paleobotany. The two others will deal with gymnosperms and angiosperms.

The present volume is a compact summary of our knowledge of fossil cryptogams, all but 22 pages being given to pteridophytes. The completeness of the summary may be judged by the fact that the bibliography includes 256 titles.—J. M. C.

Identification of trees.—In order to meet the demands of teachers for a serviceable key for the identification of trees in their winter condition, the authors of *Trees in winter* have reprinted that portion of the volume containing the keys to genera and species.[4] As indicated in the review of the original volume,[5] these keys are based upon the bud, leaf-scar, twig, and occasionally upon the fruit characters. It is anticipated that the convenience of the key in a separate form will be appreciated as an important addition to the equipment for the winter study of our tree flora.—GEO. D. FULLER.

NOTES FOR STUDENTS

Self-sterility.—CORRENS[6] has recently made the phenomena of self-sterility in plants the basis for a searching genetic investigation. After some preliminary experimentation, *Cardamine pratensis* was selected as the material best suited to his purpose, especially as some light had already been thrown upon self-sterility in this species by the investigations of JOST and HILDEBRAND. CORRENS began his study with two specimens of *Cardamine pratensis*, which though derived from the same source (Munster Botanic Gardens) differed markedly in many characters, and were both self-sterile. These two plants (for convenience labeled *B* and *G*) were crossed reciprocally. The offspring, 60 in number, were tested out individually for self-sterility by pollinations (1) from the parents, (2) on the parents, and (3) from sisters. The results are given in such great detail and with such a large amount of easily followed tabular data, that no critic of modern genetic experimental work can criticize the evidence presented on the ground that the details are not all given, or that

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[3] PELOURDE, FERNAND, Paléontologic végétale (Cryptogames cellulaires et vasculaires). 16mo. pp. xxviii+360. *figs. 80*. Paris: Octave Doin et Fils. Fr. 5.

[4] BLAKESLEE, A. F., and JARVIS, C. D., The identification of trees. Key to genera and species from "Trees in winter." 8vo. pp. 16. New York: Macmillan & Co. 1913. 30 cts. For sale only by the authors, Storrs, Conn.

[5] BOT. GAZ. **56**:79. 1913.

[6] CORRENS, C., Selbststerilität und Individualstoffe. Biol. Centralbl. **33**:389–423. *pls. I–II*. 1913.

the language is so technical that transmutations must be made before an ordinary biologist can understand it. When the F_1 plants derived from the crosses ($B\times G$ and $G\times B$) were back-pollinated with B and G, their behavior in reference to seed-setting indicated that they could be separated into four more or less distinct classes: (1) plants fertile with both B and G; (2) plants sterile with both B and G; (3) plants fertile with B, but sterile with G; (4) plants sterile with B, but fertile with G. Numerically, the 60 F_1 individuals were found to distribute themselves among the four classes in about equal proportions, the actual numbers being 16 *bg*:16 *bG*:14 *Bg*:14 *BG*.

Crosses between the individuals of these four F_1 classes, 720 of which were made, in the main confirmed the results obtained through back-crossing with the parents. Crosses between different F_1 plants and plants obtained from foreign sources all resulted in well-filled capsules. From the facts presented, the conclusion that two inhibitors were operating to present self-fertilization was a most natural and simple interpretation. Accordingly, CORRENS gives to those F_1 plants fertile with both B and G, the formula *bg*, indicating the absence of both inhibitors; those plants fertile with one parent and sterile with the other are either *Bg* or *bG*, indicating the absence of one and the presence of the other inhibitor; and lastly, those plants sterile with both B and G are said to be *BG*, indicating the presence of both inhibitors. CORRENS does not dogmatize as to the nature of these inhibitors, except to say that they are hereditary constituents of the germ plasm, which appear to segregate in Mendelian fashion some time prior to the complete development of the egg cells and pollen grains. Hence, self-sterility is not a phenomenon of "Individualstoffe" in the sense in which this term was used by JOST.

In CORRENS' scheme of interpretation, his two original plants are heterozygotes, B represented as *Bb* and G represented as *Gg*, the letters indicating the presence and absence of two distinct factors for self-sterility. *Bb* gives rise to two kinds of gametes, those with the inhibitor (B) and those without it (*b*). *Gg* likewise produces gametes with G and gametes from which it is absent (*g*). $Bb\times Gg$ is fertile, but neither $Bb\times Bb$ nor $Gg\times Gg$ would result in seed-formation, as the presence of the factor B would inhibit the growth of the pollen from the *Bb* type. The same is true regarding plants of the *Gg* type. The cross $Bb\times Gg$ results in the four types *BG*, *Bg*, *bG*, *bg*, the classes actually obtained as ascertained by the pollination tests. Types *BG*, *Bg*, and *bG* are self-sterile, while type *bg* should be self-fertile. Plants of the *bg* type should be fertile with the other three types; type *bG* is fertile with only *Bg*; type *bG* with only *Bg*; while *BG* is fertile with only *bg*. It is obvious that types *BB* and *GG* could never be formed.

CORRENS' interpretation of his results opens itself to numerous criticisms, for even the most ardent supporter of Mendelian universality would question the actuality of the four classes. Neither the data from the back-pollination experiments nor the data from those in which F_1 sisters were crossed give any notion of clear-cut classes, such as MENDEL secured in his pea work. For

example, $bg \times bg$ should be fertile, but in the tabular data one finds some *bg* plants giving "alle gut," some giving "alle nichts," and some "3 nichts, 3 gut" in crosses, and, so far as the reviewer can ascertain, no *bg* plant was fertile to its own pollen, each attempt invariably resulting in "alle nichts." The testing out of the 60 F_1 plants ($B \times G$, $G \times B$) with the parents gave similar results. Type $bg \times B$ and $\times G$ gave satisfactory evidence of complete fertility in only about a fourth of the cases, the others varying in proportions of "nichts" and "gut" on each plant tested. CORRENS recognizes these difficulties and only advances his interpretation as a crude, but helpful, working hypothesis. He believes there are many different lines of *C. pratensis*, and that these differ much in genotypical constitution, so that the various irregularities whereby his actual data differ from the theoretical expectation are assignable to this cause, that is to say, there were still other inhibitors at work of which he took no notice.

In support of this conclusion, he points out that "keines der 60 Geschwister war einem anderen oder den Eltern völlig gleich"; also, the results secured by crossing these F_1 sisters with the two foreign races. Another complication encountered by CORRENS was the reaction of the same plant toward the same pollen at different times, at one time pollinations resulting in "gut," at other times "nichts," the result possibly of obscure environmental changes.

CORRENS is to be congratulated on again being a pioneer in opening up a new field to a new viewpoint.

COMPTON[7] in two papers has also contributed to the elucidation of self-sterility phenomena. DARWIN'S observations on the existence of self-fertile and self-sterile races of *Reseda odorata* are confirmed, and in crossing experiments undertaken by this author, the following facts were obtained. Self-sterile × self-sterile gave only self-sterile offspring. Certain self-fertile plants when self-fertilized gave only self-fertile offspring; when crossed with self-sterile plants, the same result was obtained. Other self-fertile plants when self-pollinated gave approximately 3 self-fertile to 1 self-sterile offspring; when crossed with self-sterile plants, the proportion of self-sterile to self-fertile offspring is approximately 1:1. COMPTON tentatively regards self-fertility in *Reseda* as a simple Mendelian dominant, self-sterility being recessive.

In his second paper, COMPTON critically reviews the work of MORGAN, JOST, CORRENS, and other earlier investigators of this phenomenon. Until the investigations of these men, the term self-sterility was a veritable "catch-all." The general notion was extant that a self-sterile plant was fertile with the pollen of every plant of that particular species or race, a condition which all three investigators have shown to be untrue. Many records of self-sterility in species rest on faulty observation; in some cases no evidence was at hand to show that

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[7] COMPTON, R. H., Preliminary note on the inheritance of self-sterility in *Reseda odorata*. Proc. Cambridge Phil. Soc. **17**:7. 1913.

———, Phenomena and problems of self-sterility. New Phytologist **12**:197–205. 1913.

pollen had ever reached the stigma, or that having reached it, favorable conditions for germination were present. *Laburnum vulgare*, as a case in point, remains self-sterile in the absence of slight mutilations produced by insect visitors. Many examples of species with both self-sterile and self-fertile races or varieties are mentioned. An enormous variation in the degree of self-sterility is noted: at one extreme, self-pollination produces but slightly fewer seeds than cross-pollination; while at the other, a few cases are known in which the stigma and pollen of the same flower are mutually poisonous. Environment produces a marked effect on this phenomenon, as often a change in climate changes self-sterile plants to self-fertile ones. *Biophytum sensitivum* is recorded as self-sterile in its open and self-fertile in its cleistogamous flowers. Our knowledge of causes is exceedingly vague and fragmentary. Examination of stigmas fertilized with their own pollen has shown that although germination takes place, the pollen tube is inhibited in its growth in some way so that it never reaches the embryo sac. In JOST's experiments no artificial medium was discovered in which pollen tubes would grow their normal length. COMPTON suggests the presence of a soluble diffusible substance in the stigmatic or stylar tissues which acts in a positive manner toward promoting pollen tube growth. An analogy between self-fertility and immunity, and self-fertility and infection is drawn, in line with the suggestive work of JOST, SCHIFF-GIORGIONI, and others. A special section is devoted to a review of the investigations of BAUR, CORRENS, and COMPTON, on the inheritance of self-sterility, and its racial as opposed to its individual nature. Suggestive analogies are also drawn between self-sterility and certain sexual phenomena, such as non-conjugation and conjugation between different strains in certain species of *Mucor*, *Spirogyra*, and *Dasycladus*. The suggestion is made that so-called sex-differentiation in the Mucorineae may be associated with a simple type of self-sterility; homothallic species would lack inhibitors, while heterothallic species might possess two such inhibitory factors. This paper is replete with suggestion and is a review of incalculable value to all students of general biology.—O. E. WHITE.

The wood of Pinus.—GROOM and RUSHTON,[8] in their detailed account of the wood of the five East Indian pines, have kept several objects in view: the affinities of the species, tropical (hydrophytic) or xerophytic features of the wood structure, relationship of the latter to leaf structure, and the nature of the so-called "bars of Sanio." They have devoted the first part of their work to a general statement and discussion, and in the second part have given a detailed description of each species.

P. excelsa and *P. Gerardiana* belong to the HAPLOXYLON section, having single bundles to the leaves, deciduous sheaths on the spurs, tangential pitting

[8] GROOM, PERCY, and RUSHTON, W., Structure of the wood of East Indian species of *Pinus*. Jour. Linn. Soc. Bot. **41**:457–490. *pls. 24, 25*. 1913. GROOM has also given a brief account of the critical identification of the wood of the five East Indian pines in the Indian Forester **39**:409–411. 1913.